STAR

COMMUNICATION RECEIVER

SR-700A

INSTRUCTION MANUAL

STAR

STAR CO.,LTD.

INSTRUCTION MANUAL

SSB COMMUNICATION RECEIVER MODEL SR-700A

I. GENERAL DESCRIPTION

Model SR-700A is a radio receiver designed to blend in one instrument the highest possible sensitivity, selectivity and stability. Particular care has been given to the design of the tuning unit, and the variable frequency oscillator, to provide ease and facility to this receiver in the reception of single side band signals.

In order to maintain the highest sensitivity at all times, the first local oscillator is crystal controlled, and the first intermediate frequency is tunable. Each band covers a range of 600 KC. Although the receiver has been designed principally to receive the ham bands ranging from 3.5Mc to 28 Mc, it is also possible to utilize the receiver on other frequencies by the addition of appropriate crystals.

The highest quality vacuum tubes are used throughout the receiver to obtain utmost sensitivity, and the receiver features double or triple conversion for highest selectivity. Furthermore, this receiver offers four selectible stages of band width for greater selectivity, plus the rejection of unwanted carriers by means of a notch filter.

The crystal controlled first local oscillator, the highly stable circuitry of the variable frequency oscillator, the double geared precision tuning mechanism, and the 100 KC crystal controlled calibration oscillator assures the utmost in frequency stability and read out precision and give this model the following characteristics for the entire range of reception.

II. SPECIFICATION

1. Frequency Range:

Band	Tuning Range
3.5 MC	3.4 - 4.0 MC
7.0 "	7.0 - 7.6 "
14.0 "	14.0 - 14.6 "
21.0 "	21.0 - 21.6 "
28.0 "	28.0 - 28.6 "
28.5 "	28.5 - 29.1 "
29.1 "	29.1 - 29.7 "

In addition, five bands (A,B,C,D, and E) are provided through use of additional crystals, giving a full range from 4 to 30 Mc.

2. Sensitivity:

AM = less than 1 u V. for 10 dB signal - plus - noise -to - noise ratio.
CW/SSB = less than 0.5 uV signal - plus - noise - to - noise ratio.

3. Selectivity:

Optional band pass filters of 0.5, 1.2, 2.5, and 4 KC in the 6 dB band width are available by switching.

4. Notch Filter Attenuation:

Over 50 dB

5. Image Ratio:

Over 60 dB

6. Beat Interference:

Below noise level on all ham bands

7. Frequency Stability:

Less than ± 100 c/s during the first hour after warm up under normal ambient conditions.
Less than ± 100 c/s for ± 10% line voltage variation.

8. Frequency Calibration:

For each 100 KC

9. Frequency calibration read-out precision:

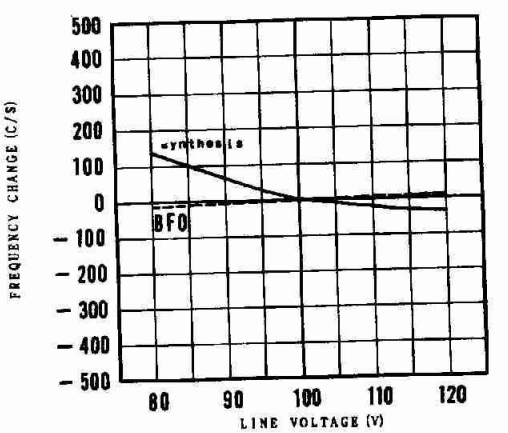
0.01% of frequency at calibrated points.
Within ± 2.5 Kc of frequency between calibrated points.

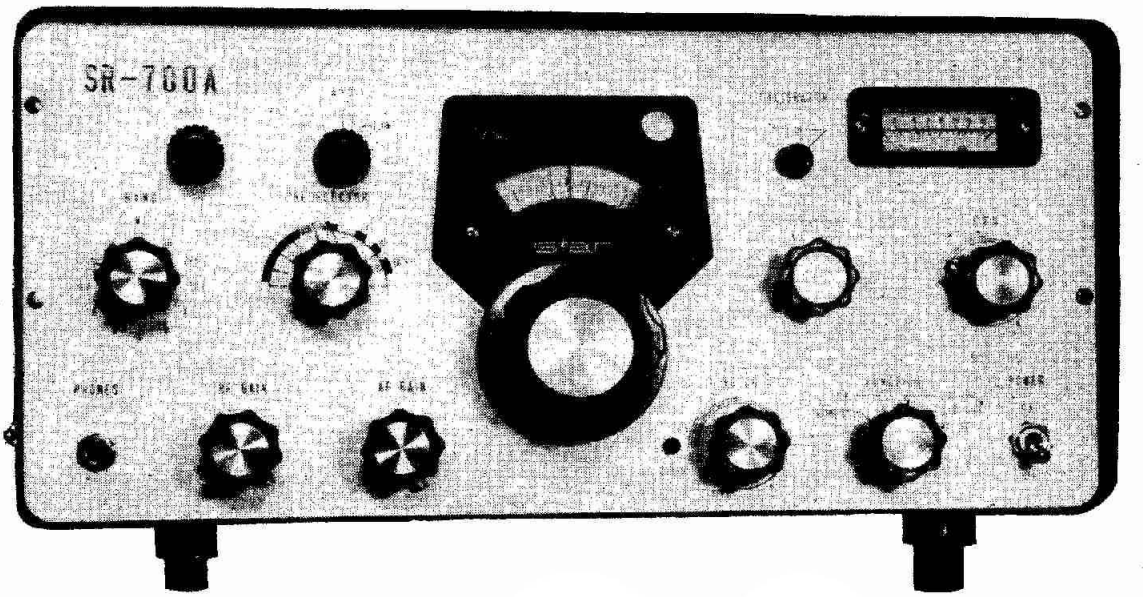
10. Undistorted power output

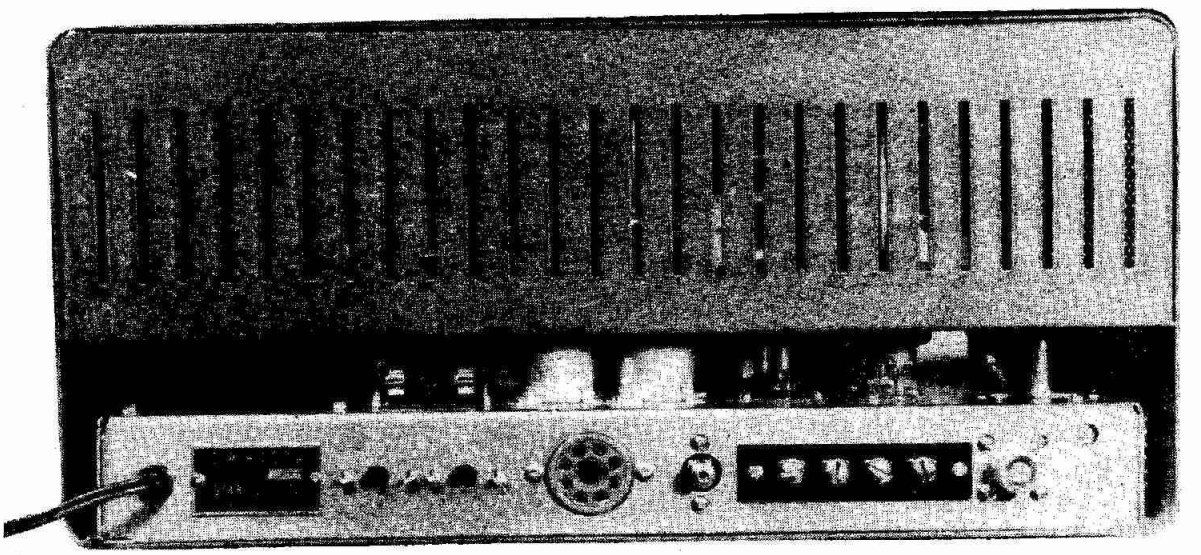
Over 1W

11. Power Supply

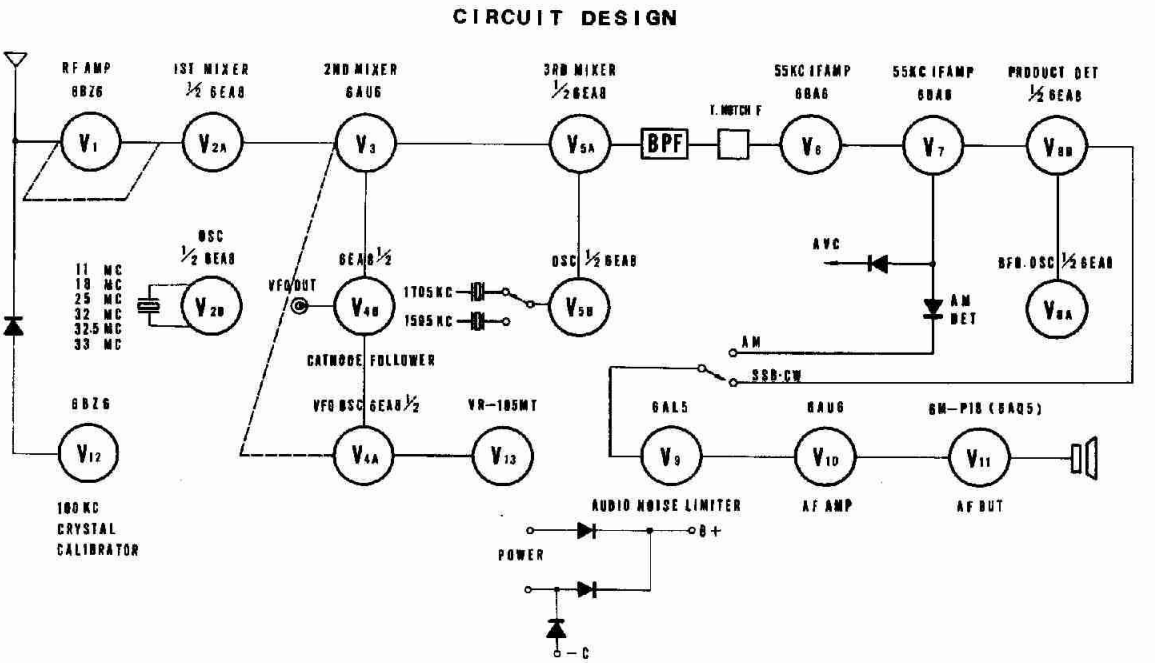
Transformers operated with silicon diode rectifiers,
Power required; AC 100V or 115V, or 230V, 50-60 c/s, 65VA.




SR-700A



III. CIRCUIT DESIGN



1. Circuitry and Receiving Tubes:

The circuit design is shown in the block diagram in Fig. 1. The names of the various components, and the receiving tube complement used are as follows:

Radio Frequency Amplifier	6BZ6
1st Converter & Crystal Controlled OSC.	6EA8
2nd Converter	6AU6
2nd Local Oscillator	6EA8
3rd Converter & Crystal Controlled OSC.	6EA8
3rd IF Amplifier	6BA6 x 2
Product Detecter BFO	6EA8
Noise limiter	6AL5
Audio Frequency Amplifier	6AQ5
Frequency Calibrator	6BZ6
Voltage stabilizer	OB2/VR-105MT
Power Supply Rectifier	Silicon Diodes(2)

2. Front Panel Controls:

Main Tuning	
Frequency Calibration Adjustment	
Band Switch	BAND
Pre-Selector Tuning	PRESELECTOR
RF IF Gain	RF GAIN
AVC Switch	AVC
Selectivity Switch	SELECTIVITY
Notch Frequency Control	NOTCH FREQUENCY
Notch Depth Control (Semi-Fixed)	NOTCH DEPTH
Beat Frequency Control	B.F.O.
Standby.AM.LSB.USB/CW Switch	FUNCTION

Noise Limiter	NOISE L
Calibration Switch	CALIBRATOR
+ S-Meter Zero Adjust	S-METER ZERO
+ S-Meter Sensitivity Adjust	S-METER SENSITIVITY

+ 100KC Crystal Oscillator Frequency Adjust

3. External Connections:

+ Antenna/Ground Terminals	(Impedance	50 - 75Ω)
+ Speaker Terminal	("	4Ω)
+ Anti-Trip Terminal	(	500Ω)

+ VFO OUT
+ Mute Terminal
+ Power Supply Cord

Phone Jack

4. Dimensions

385 Wide, 185 High (Cabinet only), 370 Deep (in mm)

5. Weight

13.6 Kg.

IV. CIRCUIT DESIGN ADVANTAGES OF SR-700A

The circuitry of the Model SR-700A has been designed to provide outstanding results for the most discriminating operators,

1. High Frequency Stability

The greatest cause of frequency variation in super heterodyne receivers results from variation in the local oscillator frequency. This problem becomes more and more serious as the received frequency increases. For this reason, SR-700A uses a crystal controlled local oscillator in order to eliminate variations in frequency due to variations in line voltage or temperature.

Similar to a crystal converter, the 1st IF stage of this receiver is not fixed, but varies within the same frequency range as the original radio frequency being received, although it is lower in frequency than the latter. In SR-700A, frequency stability is greatly improved by the conversion of the signal in the 1st IF stage into the 2nd fixed IF of 1,650 Kc.

2. Improved Frequency Reading:

By conversion of the increasing signal into a variable intermediate frequency, and further conversion in the 2nd conversion stage, the dial reading accuracy becomes quite high, enabling frequency read out accurate within 4 or 5 digits on all bands by means of a single-scale calibration.

In model SR-700A, the receiving frequency is indicated by the sum of the frequencies as indicated by BAND, the 100 KC calibrated scale and 1 KC calibrated scale.

The range of the tunable IF coincides with that of the 3.5 MC band. For this reason, there is no conversion for this band, and the frequency calibration scale is therefore reversed from those for other bands.

3. High Selectivity and Variable Selectivity:

Although lowering the intermediate frequency might improve selectivity, it would require a greater frequency ratio, and this in turn would degrade the image ratio. In order to avoid this inconvenience, double conversion is employed in the 3.5 Mc band, while triple conversion is used in the higher bands. In the triple conversion system, a 3rd IF stage of 55 Kc is provided, following a 2nd IF stage of 1,650 Kc, in order to obtain maximum selectivity. Further, a 4-step variable selectivity filter, and a notch filter, are furnished, the latter sharply eliminating interfering signals.

V. OPERATION OF RECEIVER SECTIONS

1. RF Amplifier

A high-GM tube, a 6BZ6, having a remote cut-off characteristic is used to give this section excellent low equivalent noise level, and superb performance against cross modulation.

The tuning circuit on the grid and the plate side is specifically designed to omit the change-over of the coupling coil between the input and the output. In other words, the coil used for the 7 Mc band is used as the basis, and a capacitor is added in parallel to the tuning variable capacitor in the 3.5 Mc band, while a multiple coil is inserted in the bands higher than 14 Mc.

Tuning is facilitated by means of a variable capacitor in the tuning circuit. It is operated with the PRE-SELECTOR control the front panel.

2. 1st Converter and Crystal Oscillator:

The pentode section of a 6EA8 functions as the 2nd RF amplifier in the 3.5Mc band and as the mixer in the higher bands.

The triode of the 6EA8 is a crystal-controlled local oscillator, while the 7 Mc, A, B, C, and D bands are all oscillation circuits requiring no adjustment, and in which a crystal is inserted between the grid and the plate. The 14 Mc and higher bands, on the other hand, employ triple over-tone oscillation.

3. 1st IF Stage

The intermediate frequency of the 1st IF stage varies bet-

ween 3.4 Mc. This IF stage does not amplify any frequency, but is designed to be a multiple tuning circuit by which attenuation outside the bandwidth is made sufficiently large in order to prevent generation of beat due to the interference of both the local oscillations of the 1st and 2nd converters.

The first half of this circuit is in the plate circuit of the first converter, and is appropriately damped and fixed about the middle of the band. The output is connected to the second half section of the variable frequency oscillator unit by means of a shielded cable.

4. 2nd Converter:

The second converter uses a cathode injection circuit utilizing a 6AU6 tube as a low noise level mixer. It converts the 3.4 - 4 Mc frequency to 1,650 Kc.

5. VFO

The variable frequency oscillator generates frequencies ranging from 5,050 to 5,650 Kc by means of a Vackar circuit of high stability with large capacity grounded electrodes. The oscillator circuit functions in unison with the input circuit. The variable capacitor used is a linear frequency variable capacitor, and the coil uses a steatite bobbin. The tuning mechanism is a triple double gear type, so that it enables read out directly to any frequency in a range of 600 Kc.

The output of the VFO is into the cathode follower, and may be used for transmitter operation.

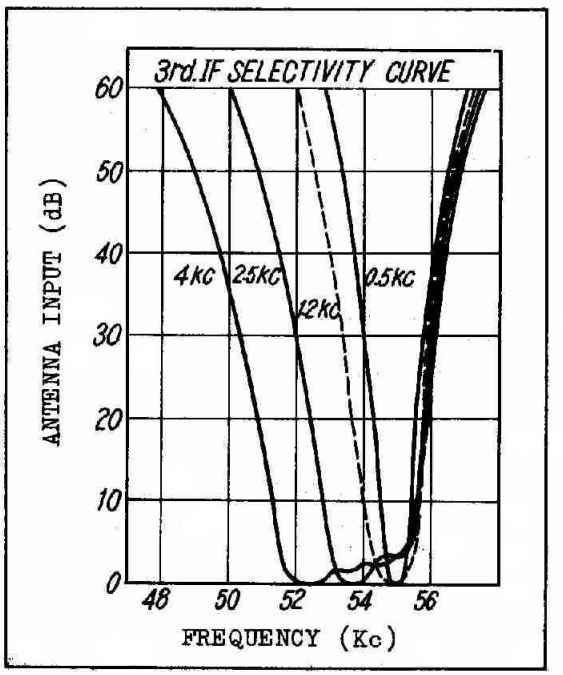
6. 3rd Converter and Crystal Oscillator Unit:

This unit mixes the input signal of 1,650 Kc and the frequency generated by crystal oscillation to convert it into 55 Kc.

The triode of the 6EA8 is a crystal oscillator, and in USB the crystal oscillation is 1,705 Kc, and in LSB it is 1,595 Kc (3.5 Mc is reversed). Its output is fed into the pentode of the 6EA8 by cathode injection.

7. 3rd IF Stage

The output of the 3rd converter unit passes into the LC 4-step concentrative filter which provides the required selectivity. This filter is designed to change its pass band width into one of four steps of 0.5, 1.2, 2.5, and 4 Kc, by changing the capacitor coupled to it. The characteristic curves in the four pass band widths are shown in Fig. 2. The center frequency in the 0.5 Kc pass band width is 55 Kc. The curve expands towards lower frequencies with the higher pass bands. This method of filtering has the advantage of having the carrier position fixed constantly in single side band reception.



The output of the variable filter passes into the notch filter and is fed into the amplifier tube 6BA6. The notch filter sharply attenuates a specific frequency by the principle of a bridge T filter, which is highly effective in the elimination of interfering signals within the pass band width. Elimination of frequencies is attained by tuning the core in the coil.

8. Product Detector:

For SSB and CW reception, the triode section of a 6EA8 is used as a product detector, and the pentode section is used as BFO to feed the oscillation voltage to the cathode of the triode.

The use of a triode for product detection permits a large undistorted input signal, thus making it easy to handle, and providing an excellent S/N ratio.

The BFO oscillator circuit is a high C circuit, and its oscillation frequency is low, thereby assuring sufficient stability.

The oscillation frequency of the BFO may be adjusted by tuning the core of the oscillation coil. One turn of the BFO control is the equivalent of 15 Kc variation in frequency, and this enables fine frequency adjustment suitable for SSB reception.

9. AM Detection and Noise Limiting:

For AM reception, A 1N34A diode is used as a diode detector. Noise limiting is provided by use of an audio clipper system which clips the positive and negative wave heads of the low

frequency input, thereby effectively eliminating pulse noises, such as switching of electrical circuits and automobile ignition noise. The clipping range can be varied by means of a variable resistor.

10. AVC Rectifier and Bias Rectifier:

The AVC rectifier is a silicon diode 1S182. A power diode is used for rectifying part of the alternate current of the B power supply to obtain a negative voltage of about -50 V, which is superimposed on the AVC voltage through the variable resistor of the RF-GAIN circuit. When AVC is off, this negative voltage is applied to the RF, the 1st converter, and the 3rd IF stages to control gain. The time constant of the AVC circuit may be made large or small. The position of the AVC switch for the smaller time constant is indicated as FAST, the position of the larger time constant as SLOW. The AVC will not operate at the OFF position. The overall gain of this receiver is extremely large, so that a weak signal or noise input also generates an AVC voltage. If the gain of the RF stage is lowered due to this AVC voltage, the S/N ratio will be lowered at the time of a small input. For this reason, a DAVC circuit utilizing the characteristics of 1 M, and 1S182, is inserted in the AVC circuit of the RF amplifier and the first converter stage.

11. S-Meter Circuit:

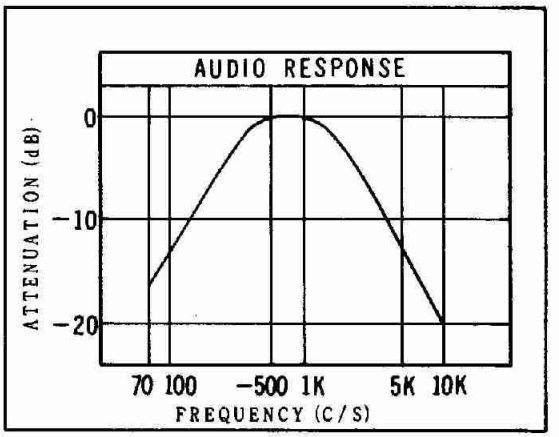
The S-Meter circuit is in the cathode circuit of the second section of the 3rd IF amplifier. This meter is provided with a zero balance resistor for current wipe out, so that its indication becomes zero when there is no input. When AVC is applied by the input signal, this meter will indicate the decrease in the cathode current due to the AVC application.

The sensitivity resistor is designed to be used for adjusting the movement of the meter indicator to the input intensity.

12. Audio Frequency Amplifier:

Detector output, selected by means of the FUNCTION switch, passes the noise limiter and AF GAIN, and is amplified sufficiently by the 6AQ5, passing through the output transformer to the speaker terminals. From the secondary coil of the output transformer, approximately 5 dB of NFB is applied to the cathode of the 6AU6, in order to meet the wide range of the load impedance.

The frequency characteristics following the detector stage are designed to improve the S/N ratio, and to provide a tone quality which becomes easy to listen to by appropriate attenuation of the sound range, as shown in the figure.



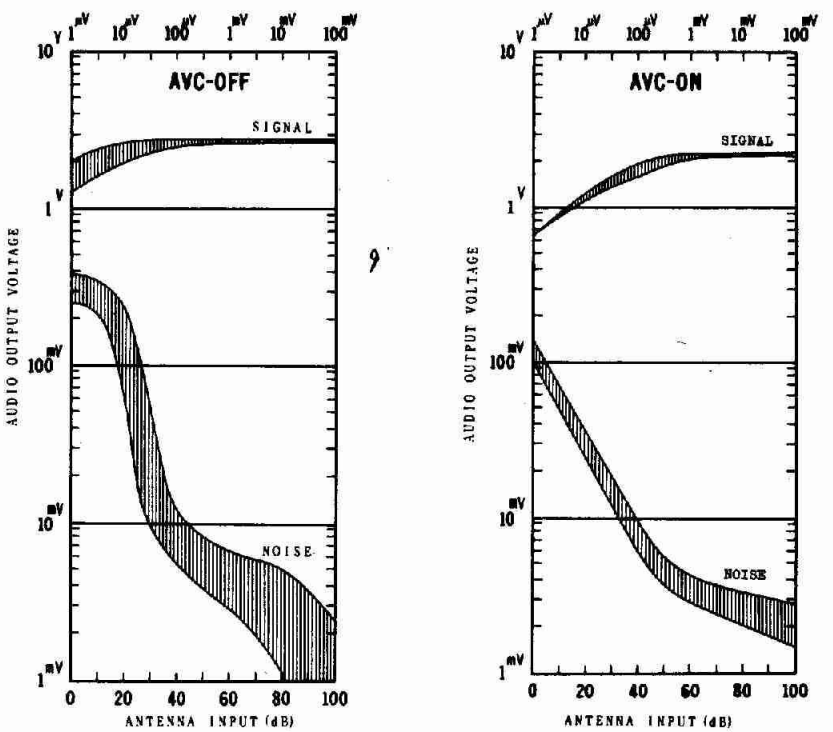
13. Frequency Calibrator:

A crystal of 100 Kc is inserted between the grid and the screen of the 6BZ6, and the RF output is taken out from the plate of 6BZ6 and applied to the input of the receiver for calibration of the frequency scale. The maximum receiving frequency is 30 Mc, so a 1N34A is inserted in the coupling unit to reinforce the harmonics and to obtain a sufficiently strong marker signal at every 100 Kc up to the highest frequency.

14. Power Supply

A terminal of 115V and another of 230V are provided on the primary coil of the power supply transformer. The B power supply uses a silicon rectifier for full-wave rectification, plus a filter choke in order to provide filtering with sufficient regulation.

FIGURE: Figure shows S/N ratio on following conditions; AVC-ON, RF GAIN-MAX., RF INPUT-0dB(1 uV), AF OUTPUT-100mW



VI. OPERATING INSTRUCTIONS

1. Preparation for Reception:

+ Power Supply - The rated voltage of the power supply of this receiver is AC 115V, or 230V 50/60 c/s, but it can be used without trouble between 105 and 120V, or 220 and 240V. Connect the power supply cord to the power supply, turn on the POWER switch under the right terminal on the panel, and the dial will be illuminated, indicating that the power supply is turned on.

+ Speaker or Head Phones - Although the output impedance of the speaker is rated at 4Ω, it can be used without trouble within the range of 2 to 8Ω.

For use with head phones, low impedance type head phones are recommended, but high impedance head phones may be used for listening at an appropriate signal volume.

The insertion of a head phone plug into the phone jack will automatically cut off the power supply to the speaker.

2. AM Reception:

+ Position of Controls -

FUNCTION	AM
SELECTIVITY	2.5 Kc or 4 Kc
NOTCH	OFF
AVC	FAST
RF-GAIN	Clockwise up to Max.
AF-GAIN	Level of barely audible noise
BAND	As desired
PRESELECTOR	Point at which noise becomes maximum near the mark of the desired band.

+ Calibration and Reading of Frequency Scale -

Turn on the CALIBRATOR switch, turn the tuning knob, and the S-meter indicator will swing around each 100 Kc of the upper scale. At any such point, the small metal knob on the dial plate may be used to set the indicator to zero beat in the 100 degree scale.

During reception with CALIBRATOR turned off, the frequency being received is indicated by the sum of the MC of the particular BAND, 100 Kc indication of the upper scale, and in Kc the 100 degree scale.

+ Fine Control -

When tuning a station, adjust the main tuning control so that the indicator of the S-meter shows the largest swing. Adjust PRESELECTOR to maximum.

The sound volume is controlled by the AF GAIN control. The AVC control is turned either to SLOW or to FAST, depending upon the condition of the frequency being received.

+ Eliminating Noise -

Pulse noises may be eliminated by adjustment of the variable resistor of the noise limiter (NOISE-L) to vary the clipping level in accordance with the noise intensity, in order to get the best reception.

+ Eliminating Interference -

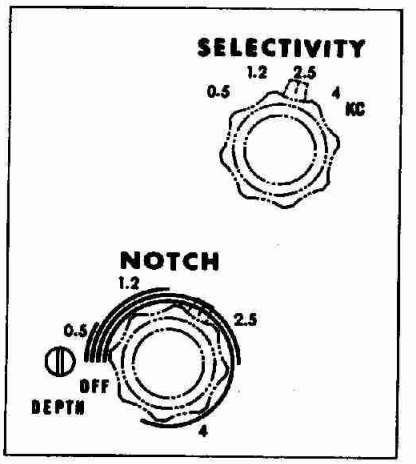
Interference to reception may be reduced or eliminated by selection of a narrow band pass width of 1.2 Kc by means of the SELECTIVITY control. However, for near-by signals and heterodynes that cannot be eliminated by means of the narrow band pass filter, use of the NOTCH control may effectively eliminate them. DEPTH is pre-adjusted to the sharpest and deepest skirt signal level to eliminate interference, and further adjustment may be omitted.

The four black lines marked on the panel indicate the ranges of NOTCH frequencies corresponding to the respective band pass ranges.

When NOTCH is set in the particular band pass range, the band pass width characteristic will be changed. For this reason, the NOTCH control should always be kept turned off when use of the notch filter is unnecessary.

+ Short-time Stand-by or Transmission -

Receiver operation is muted, but the power supply remains on when the FUNCTION control is turned to the STAND-BY position. When used in combination with a remote control, or with a transmitter, the receiver can be kept in the stand-by condi-



tion by manipulating a switch or relay so that the MUTE terminals Nos. 2 and 3 in the GT socket on the back panel are connected when the switch is turned to AM.

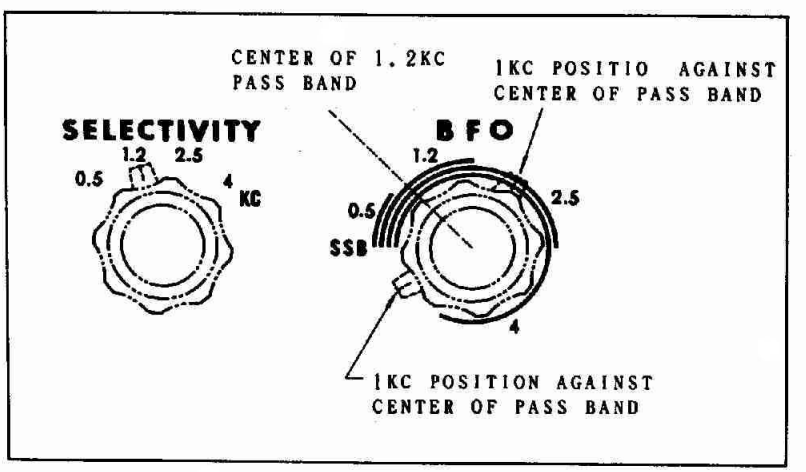
This can also be applied to SSB/CW reception.

+ S-Meter -

The pointer of the S-meter, swings depending upon the varying strength of carrier being received, and not only serves as a tuning indicator but also shows roughly the strength of the incoming signal by means of S-scales and dB.

The S-scale shows the internal noise level as 1, and approximately 50 μV of antenna input as 9. Readings above S9 are read in dB over S9. The signal input becomes slightly larger above 21 Mc.

When RF GAIN is turned to the minimum level, or the receiver is at STANDBY, the pointer of the S-meter will swing over, but this should cause no concern.



3. CW Reception:

+ Position of Controls -

FUNCTION	LSB or USB (Choose for best reception depending on band in use)
SELECTIVITY	0.5 Kc or 1.2 Kc
NOTCH	OFF
AVC	OFF
RF GAIN	Fully turned clockwise
AF GAIN	Barely audible level of noise
BAND	As desired
PRESELECTOR	Point at which noise becomes maximum near the mark of band in use
BFO	SSB

+ Frequency Scale Calibration and Reading -

Turn AVC to FAST, and read frequency of reception as in the AM reception.

For reading at zero beat, set the BFO control at the center of 0.5 and 1.2, and the SELECTIVITY control at 1.2 Kc.

+ Fine Control -

The four lines marked on the panel show positions of BFO frequencies corresponding to the respective band pass filters.

In CW reception, turn the tuning control carefully to obtain the clearest tone level.

When necessary, the pitch may be changed by means of the BFO control.

When receiving weak signals, RF GAIN should be increased, while AF GAIN should be decreased. When signals are strong, or external noise is heavy, reception will be helped by decrease of RF GAIN.

PRESELECTOR should always be set for the optimum condition. Two different AVC time constants (FAST and SLOW) are provided to enable best CW reception.

NOISE L is to be manipulated as in AM reception.

+ Elimination of Interference -

The narrow pass band width, and the NOTCH filter, should be utilized as in AM reception.

4. SSB Reception:

+ Position of Controls -

FUNCTION	For SSB reception in the 7 Mc band, set at LSB. For 14 Mc and above, set at USB. Since reception in the 3.5 Mc band is designed to be in double conversion, the control should be set at the red letter indications, for reception of SSB mode on this band.
SELECTIVITY	2.5 Kc
NOTCH	OFF
AVC	OFF or SLOW
RF GAIN	Fully turned clockwise
BAND	As desired
PRESELECTOR	A point at which noise becomes maximum near the mark of desired band
BFO	SSB

+ Frequency Scale Calibration -

Indicated frequency should be read as in AM or CW reception.

+ Fine Adjustment -

As the main tuning control is gently turned, a point will be reached where clear sound is obtained by demodulation. Set the control to this point.

There is a knack about SSB reception, but it will become quite simple when you get used to it.

Increase RF GAIN and decrease AF GAIN for reception of weak signals. On the other hand, decrease RF GAIN for strong signals.

+ Elimination of Interference -

If SELECTIVITY is set at 1.2 Kc or 0.5 Kc for the purpose of eliminating interferences, the position of the BFO control will move near the right end of the black line indicating the respective band width.

NOTCH is to be used as in AM and CW reception.

VII. MAINTENANCE AND ADJUSTMENT

1. Removing the Case:

To remove the case from the panel and chassis, unscrew the four screws on the bottom of the receiver and push the chassis from behind.

2. Removing the Panel:

The following steps should be observed when removing the panel of the receiver.

1) Remove all control knobs. Since every control knob is fastened at two spots by set screws, both set screws must be loosened before removing the control knob.
2) Remove the mounting nut of the switch variable resistor jack.
3) Remove the panel at the position when the indented section of the indicator shaft of PRESELECTOR matches the red line.
4) Unscrew the mounting screws on the left and right edges of the panel
5) Unscrew the mounting screws of the S-Meter.
6) Remove the wiring of the variable capacitor of the calibrator.

3. Mounting:

To mount the panel, take the above steps in reverse order. All set screws of receiver should be tightened firmly, and in particular be sure to fasten both set screws of the control knobs.

Control knobs with indicators are designed to indicate correctly when mounted so that the opposite set screw opposite the indicator comes to the indented section of the shaft.

4. Replacement of the Dial Illumination Light:

The dial illumination light of the receiver should be one with a Swan base of 8 V rated voltage.

5. Replacement of Vacuum Tubes:

The vacuum tubes used in Model SR-700A are commonly used in radio and television receivers. Among them, however, 6BZ6 and 6EA8 are relatively uncommon. Several of these tubes are used in this model and can be interchanged to check efficiency of function.

The 6BZ6 used in the calibrator may be replaced by a 6DK6 or 6BA6 tube.

6. Repairing Diodes:

The type of silicon diode used in the power supply is commonly available on the open market for television receivers.

Since the 1S182 inserted in the AVC detector circuit, and the AVC circuit, is fed with a high negative voltage during the time of stand-by, it should be replaced by a diode having over 100V reverse withstand voltage.

The 1N34A in the calibrator circuit may be replaced by another type of diode possessing substantially the same characteristics, or it may be short-circuited if the marker signal should be weak.

7. Adjustment of 3rd IF Transformer:

Set Function at AM, connect a vacuum tube voltmeter between Pin 9 of the product detector 6EA8 and the chassis, and adjust for maximum output while applying an output signal of 53 Kc from an RF signal generator to Pin 1 of the second half stage (single tuning side) 6BA6 of the 3rd IF amplifier.

Next, adjust the 3rd IF transformer so that the output variation comes within 1 dB between ± 2 Kc with 53 Kc at center indication of the vacuum tube voltmeter when the frequency is varied by feeding the output of the RF signal generator to Pin 1 of the 6BA6 on the double tuning side.

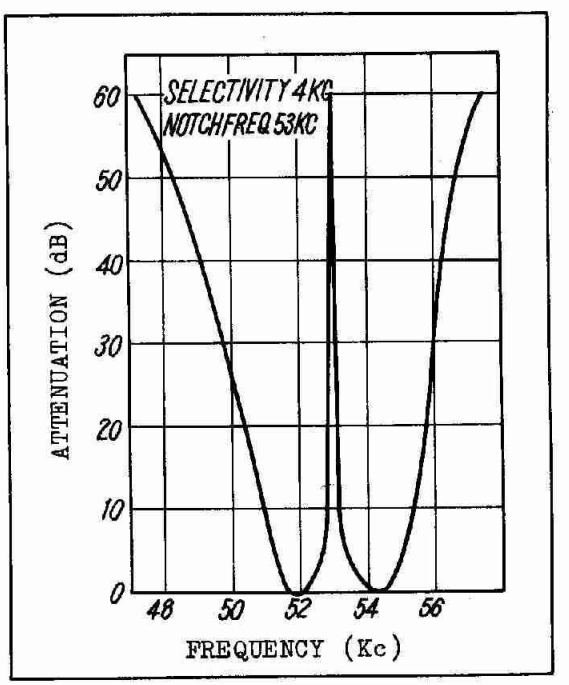
Use an insulated screw driver which fits well into the core groove when adjusting the core.

8. Adjustment of Variable Selection Filter (Selectivity):

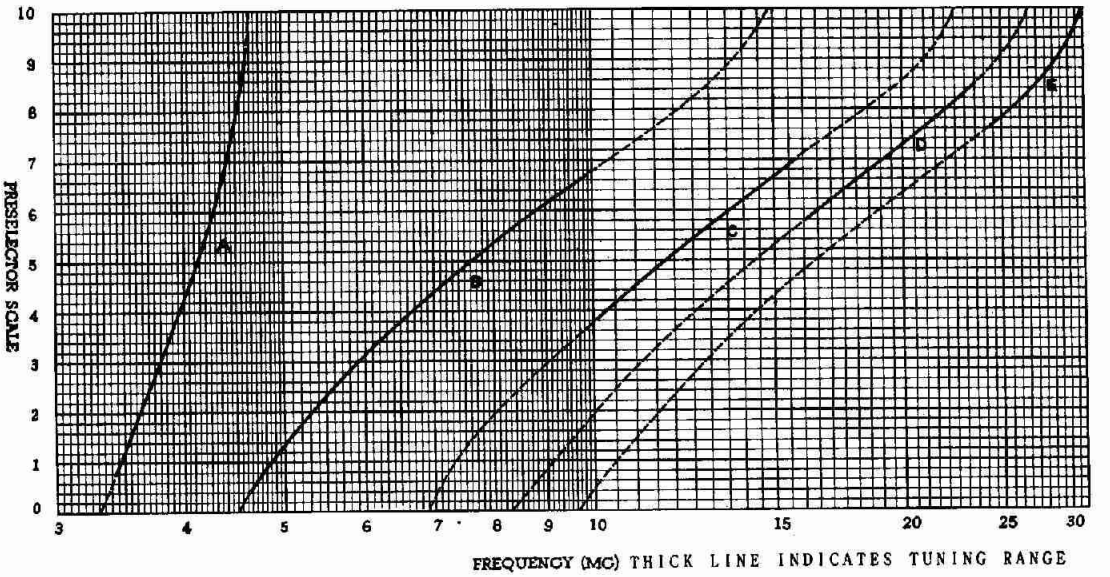
Connect a vacuum tube voltmeter for RF, as described in the previous item. Connect an RF signal generator between Pin 2 of the 3rd converter 6EA8 and the chassis, and set the Generator signal at 55 Kc unmodulated.

Adjust for a sharp single peak characteristic by varying the frequency of the signal generator after setting SELECTIVITY at 0.5 Ko and adjusting alternately the four coil cores in such a way that the indicator of the vacuum tube voltmeter shows the largest swing. Check that the accurate band width is obtained at each band (0.5 Kc, 1.2 Kc, 2.5 Kc, 4 Kc), by switching SELECTIVITY.

9. Adjustment of NOTCH:



Set NOTCH at the point where the output decreases by turning the NOTCH knob after applying a signal of 55 Kc in the same connection triode as used in adjusting the variable selection filter.



Next, adjust the resistor of DEPTH, so that output will further decrease. In this way, adjust both controls alternately to obtain the largest attenuation. When this condition has been attained, remount the control knob so that the indicator of the control knob will come to the center of the 0.5 arc.

For a simple check, turn SELECTIVITY to 0.5 Kc, turn on CALIBRATOR, and tune so that the indicator of the S-meter shows the largest swing by its signal. Next, adjust NOTCH and DEPTH to match the indicator of the control knob.

10. Adjustment of BFO:

Turn SELECTIVITY to 0.5 Kc, turn off CALIBRATOR, turn FUNCTION to LSB or USB, tune so that S-meter indicator shows the largest swing, tune BFO, and set the control knob indicator so that the center of the arc line of 0.5 will coincide with the position of zero beat.

11. Adjustment of 2nd IF Transformer:

Turn SELECTIVITY to 4 Kc, and supply 1650 Kc from an RF generator to Pin 1 of 6AU6 of the 2nd mixer.

Adjust the two cores of the 2nd IF transformer to the point of the largest swing of the S-meter.

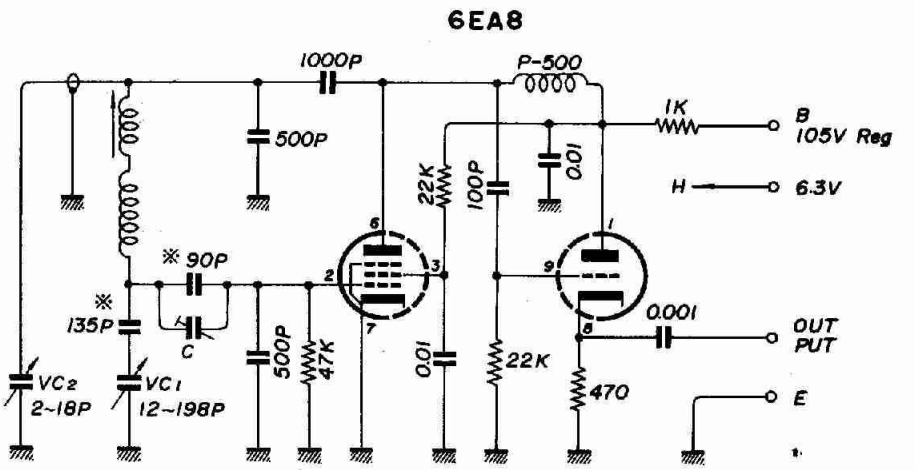
12. Adjustment of VFO:

VFO is held within 2.5 Kc of the receiving frequency between calibration points. Should deviation occur, or when it is desired to eliminate error at a desired frequency, adjustment can be made by the same methods utilized in the tracking adjustments in the receiver.

A standard broadcast signal together with the 100 Kc marker may be utilized as marker signals.

Error may either be an expanded frequency or a reduced frequency. When it is an expanded frequency as seen in the dial scale, insert L at the oscillator 6EA8, and reduce C.

When the frequency is reduced, adjust in the reverse manner. To adjustment of the core and trimmer of the VFO, a screw driver made of insulating material should be used. The double gear mechanism should not be oiled. Oiling may cause backlash.



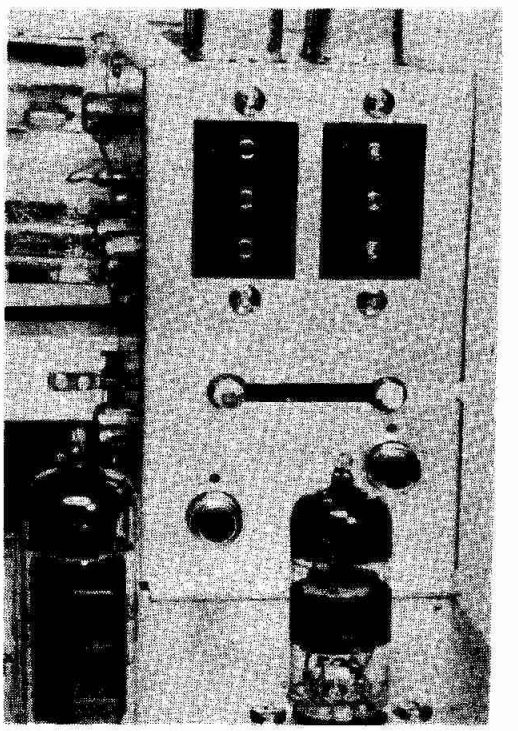
13. Adjustment of Crystal Oscillator (1st Local Oscillator):

Note that the indicated frequency on the crystal is the frequency of the crystal oscillation, and the indicated frequency of the crystal socket and coils are shown in meters.

Crystals for the 40 m (7 Mc band) and A,B,C, and D bands, will oscillate simply by inserting a crystal in the appropriate socket, and require no adjustment. When it is necessary to check the presence of oscillation, connect a vacuum tube voltmeter, or a VOM of high internal resistance, between the test point (TP) provided near the 6EA8 and the chassis in the DC3 -5 V range, and with negative voltage indicated, oscillation is present.

In the 20 m (14 Mc band), 15 m (21 Mc band), and 10 m bands,

namely the 10a (28Mc band), 10b (28.5 Mc band), and 10c (29.1 Mc band) and E band, there is third overtone oscillation. For this reason, adjust the core of the ccil with its respeotive code, and match it so that the meter connected to TP shows the largest swing.



14. Adjustment of PRESELECTOR:

Remove the antenna, turn RF GAIN to max, and tune PRESELECTOR. A clear tuning noise at the appropriate place of each band, indicates that the action of the PRESELECTOR is normal. If there is no increase in noise level when tuning, then check if change occurs by exchanging the RF amplifier 6BZ6, with the 1st converter tube 6EA8.

Readjustment of the PRESELECTOR tuning coil is accomplished as follows:

Turn BAND to 7 Mc, and PRESELECTOR to 4/7. Feed a 7.3 Mc signal from an RF signal generator to the A.G. terminal, and adjust the tuning control knob so that the S-meter indicates the largest swing. After this step, adjust the coils on both sides of the upper 6BZ6, so that the S-meter indicates the largest value.

Next, turn BAND to 28.8 Mc and PRESELECTOR to 9. Apply a 28.8 Mc signal from an RF signal generator and adjust both cores under the variable capaciter so that the S-meter will indicate the largest value. Finally, turn BAND to 3.5 Mc,

apply a 3.7 Mc signal and adjust tuning and PRESELECTOR to make the indication of the S-meter the largest, and then adjust the trimmer in the antenna coil unit.

15. Adjustment of S-meter:

Short-circuit the A.G. terminal. Turn RF GAIN to max., AVC to FAST or SLOW, and FUNCTION to AM. Turn SELECTIVITY to 2.5 Kc, and BAND to 7.3 Mc or 14.3 Mc (whichever is more frequently used), adjust PRESELECTOR so that the tuning noise becomes largest. Under these conditions, adjust S-meter ZERO on the back panel of the chassis so that the S-meter indicator will show 1.

Next, connect the output of an RF signal generator of 50Ω output impedance (in case it is less than 50 , insert a series resistor to raise it to 50Ω) to the A.G. terminals, and adjust the generator frequency by applying an unmodulated signal of 50 μV (34 dB) to the reception so that the S-meter shows the largest swing. Under this condition, adjust S-METER SENSITIVITY on the back of the chassis so that the S-meter indicator will indicate 9.

16. Adjustment of the 100 Kc CALIBRATOR:

If there is a frequency counter available, connect it with Pin 5 of the oscillator tube 6BZ6 through an appropriate capacitor, and adjust the trimmer on the back so that the oscillation frequency will precisely match 100 Kc.

Another method is as follows. Tune the receiver to any 5 Mc, 10 Mc, or 15 Mc standard Signals (WWV), and connect the output of CALIBRATOR to the input unit of the receiver so that a beat note can be heard, and adjust the trimmer on the back so that zero beat will be attained.

With the crystal supplied with this model, it will suffice to adjust the trimmer. But in case the frequency cannot be matched to 100 Kc with other crystals, adjust the capacitor connected in parallel to the trimmer.

17. Reception in Bands other than Ham Bands:

For reception of any given frequency between 4 Mc and 30 Mc utilizing the additional bands designated A,B,C,D, and E, the frequency of the crystal for the 1st local oscillator and the PRESELECTOR should determined in the following manner.

+ Frequency of Crystal -

The crystal oscillator may be made to oscillate at a frequency either in the upper heterodyne, or lower heterodyne. For a relatively low frequency, it is better to use the upper heterodyne, and for a relatively high frequency, the lower heterodyne will facilitate oscillation.

To determine the crystal frequency for a desired receiving frequency, the following equation should be used.

Crystal frequency of upper heterodyne = lowest receiving frequency + 4 Mc (to be read in black scale)

Lower heterodyne + crystal frequency = highest receiving frequency - 4 Mc (to be read in red scale)

To facilitate frequency calibration read-out, it is desirable to use a crystal whose oscillation frequency is a whole number, not including a fraction.

+ Types of Crystals -

Use HC-6/U type crystal, and use a crystal for basic oscillation by non-adjustment circuit for oscillation frequencies under 20 Mc, and use a crystal for triple overtone for over 20 Mc.

+ Frequency Received and BAND Position -

The BAND positions corresponding to the receiving frequencies are as follows.

Receiving Frequencies (Mc)	BAND	Crystal Mode
4.0 - 4.6	A	Basic oscillation
4.6 - 10.0	B	"
10.0 - 16.0	C	"
16.0 - 24.0	D	"
24.0 - 30.0	E	Triple overtone

The crystal should be inserted into the socket on the back of the chassis corresponding with BAND.

+ PRESELECTOR Positions -

+ Roughly the positions of the PRESELECTOR for the OFF-BAND frequencies are shown below.

+ Frequency Reading -

When the crystal frequency is higher than the receiving frequency (upper heterodyne), it should be read in black letters as follows:

Frequency = [crystal frequency (Mc) - 4 Mc + 100 Kc scale] + 1 Kc scale.

When the crystal frequency is lower than the receiving frequency (lower heterodyne), it should be read in red letters as follows:

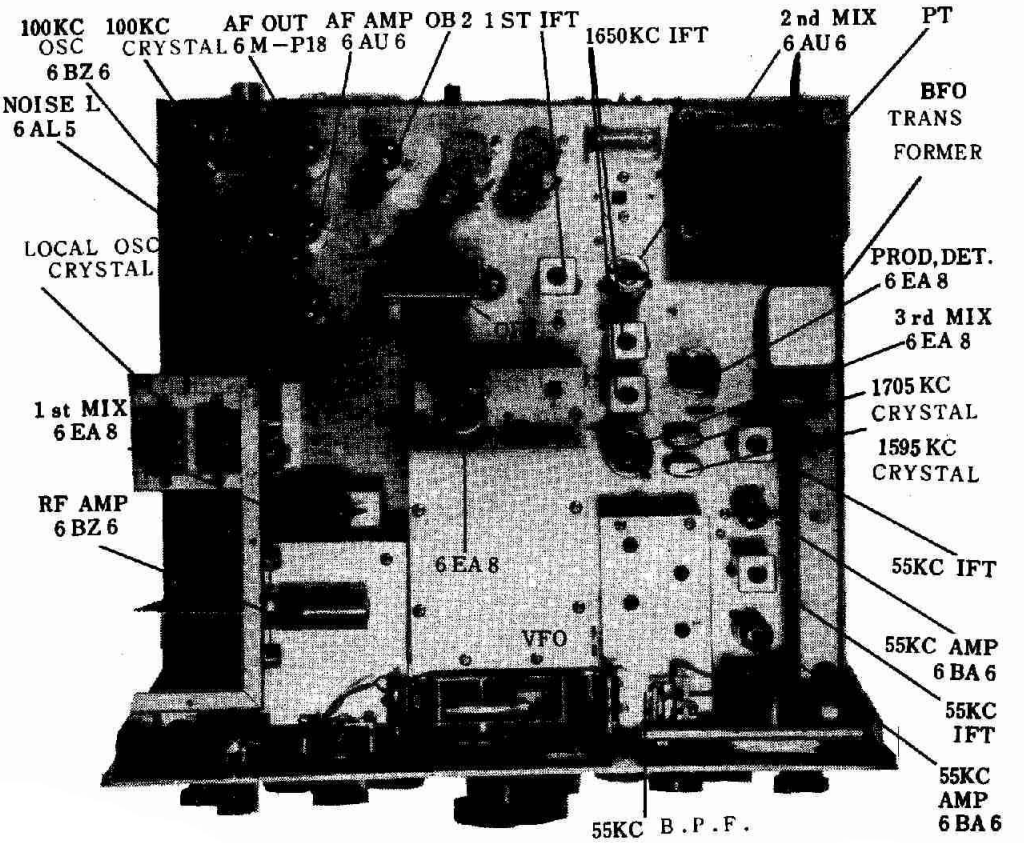
Receiving frequency = [crystal frequency(Mc) + 3.5 Mc] + 100 Kc scale + 1 Kc scale

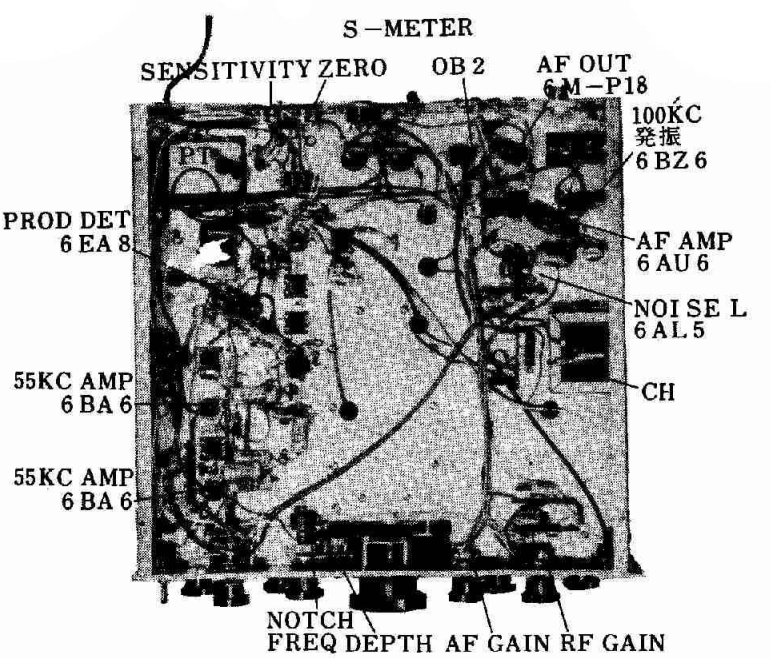
+ Adjustment of E Band -

The A/D bands are non-adjustable, and they may be operated by simply inserting a crystal into the socket. But the E band crystal must be adjusted to its coil. For this purpose, connect a vacuum tube voltmeter in DC3/-5V mode between the test point provided near the 6EA8 of the preselector unit and the chassis, and carefully adjust the core of the BAND E coil so that the meter needle shows the largest swing. For this adjustment it is necessary to use a screw driver made of insulating material that fits well into the groove of the core.

If a VOM tester is used as the meter, it is advisable to use one with as large as internal resistance as possible.

A similar method may be used for checking the oscillation in other bands than E band.


100KC OSC 6BZ6
100KC CRYSTAL
AF OUT 6M−P18
AF AMP 6AU6
OB2
1 ST IFT
1650KC IFT
2nd MIX 6AU6
PT
BFO TRANS FORMER
NOISE L 6AL5
LOCAL OSC CRYSTAL
PROD, DET. 6EA8
3rd MIX 6EA8
1705 KC CRYSTAL
1595 KC CRYSTAL
1st MIX 6EA8
RF AMP 6BZ6
6EA8
55KC IFT
VFO
55KC AMP 6BA6
55KC IFT
55KC AMP 6BA6
55KC B.P.F.


S−METER
SENSITIVITY ZERO
OB2
AF OUT 6M−P18
100KC 発振 6BZ6
PT
PROD DET 6EA8
AF AMP 6AU6
NOISE L 6AL5
CH
55KC AMP 6BA6
55KC AMP 6BA6
NOTCH FREQ
DEPTH
AF GAIN
RF GAIN

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